

**CLAIMS****What Is Claimed Is:**

- 1           1.     A continuous method for the recovery of zinc oxide from waste  
2     material streams which comprise zinc compounds, comprising the steps of:
  - 3               a.     roasting said waste material at an elevated temperature and  
4     in a reducing atmosphere;
  - 5               b.     treating said waste material with an ammonium chloride  
6     solution at an elevated temperature to form a product solution which comprises  
7     dissolved zinc and dissolved zinc oxide whereby any iron oxide in said waste  
8     material will not go into solution;
  - 9               c.     separating said product solution from any undissolved  
10    materials present in said product solution including any of said iron oxide;
  - 11              d.     adding zinc metal and a dispersant to said product solution  
12    whereby any lead and cadmium ions contained within said product solution are  
13    displaced by said zinc metal and precipitate out of said product solution as lead  
14    and cadmium metals and said dispersant is selected from the group consisting of  
15    dispersants which will prevent the aggregation of said zinc metal;
  - 16              e.     separating said product solution from the lead and cadmium  
17    metals;
  - 18              f.     lowering the temperature of said product solution thereby  
19    precipitating the zinc component as a mixture of crystallized zinc compounds;
  - 20              g.     separating said precipitated zinc compounds from said  
21    product solution;
  - 22              h.     washing said precipitated zinc compounds with a wash water  
23    thereby solubilizing certain of said precipitated zinc compounds;
  - 24              i.     separating remaining precipitated zinc compounds that have  
25    not solubilized from said solution;
  - 26              j.     drying said remaining precipitated zinc compounds at a  
27    temperature of at least 100°C whereby said resulting product is zinc oxide of 99%  
28    or greater purity by weight;

29 k. dissolving said resulting product in a concentrated sodium  
30 hydroxide solution;

31 l. filtering out any undissolved materials;

32 m. dispersing said sodium hydroxide solution into droplets  
33 between 100 and 300 microns in size;

34 n. combining said droplets with a sufficient amount of 70°C to  
35 100°C water to dilute the solution by a factor of 3 to 30 by volume, thereby  
36 precipitating zinc oxide crystals; and

37 o. filtering out said zinc oxide crystals.

1 2. The method of Claim 1 further comprising the steps of:

2 p. washing said zinc oxide crystals in water; and

3 q. adding an acid to said zinc oxide crystals; wherein said acid  
4 reacts with the zinc oxide to form a zinc compound.

1 3. The method of Claim 2, wherein said acid is selected from the group  
2 consisting of acetic acid, boric acid, bromic acid, carbonic acid, chromic acid, nitric  
3 acid, phosphoric acid, stearic acid, gluconic acid, hydrochloric acid, sulfuric acid,  
4 and edetic acid.

1 4. The method of Claim 1, wherein, in step (h), said wash water is  
2 above 25°C.

1 5. The method of Claim 4, wherein said wash water is at a temperature  
2 of 60°C to 100°C.

1 6. The method of Claim 5, wherein said zinc compounds are washed  
2 with water at a ratio of between 0.1 and 2 pounds of zinc compounds per gallon of  
3 wash water.

1 7. The method of Claim 6, wherein the temperature and the ratio of  
2 water to zinc compounds is controlled to obtain zinc oxide crystals having a  
3 desired surface area.

1 8. The method of Claim 1, wherein, in step (m), said droplets are  
2 between 150 and 250 microns in size.

1 9. The method of Claim 1, wherein the size of said droplets in step (m)  
2 is controlled to obtain zinc oxide crystals having a desired surface area.

1           10.    The method of Claim 1, wherein, in step (n), said amount of water is  
2   sufficient to dilute the solution by a factor of 3 to 8 by volume.

1           11.    The method of Claim 1, wherein, in step (n), said water is at a  
2   temperature ranging from 90°C to 100°C.